Four new conservation-listed species of *Synaphea* (Proteaceae: Conospermineae) from the Jarrah Forest region of south-west Western Australia

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Abstract

Butcher, R. Four new conservation-listed species of *Synaphea* (Proteaceae: Conospermineae) from the Jarrah Forest region of south-west Western Australia. *Nuytsia* 17: 97–116 (2007). The new species described here are a diverse assemblage of taxa, united in this paper by their geographical occurrence within the Jarrah Forest region of south-west Western Australia and a pressing need to formalise the description of conservation taxa in this State. The taxa have complex taxonomic associations within the groups to which they belong, with intergradation in many characters evident between species. The new species described herein are *S. diabolica* R.Butcher, *S. pandurata* R.Butcher, *S. polypodioides* R.Butcher and *S. trinacriformis* R.Butcher. A distribution map, image and discussion of affinities are provided for each taxon.

Introduction

The Jarrah Forest region (Thackway & Cresswell 1995) lies on the south-western margin of the Great Plateau of Western Australia, developed on the Archaean crystalline rocks of the Yilgarn Block (Churchward & Dimmock 1989). Modern distribution of jarrah (*Eucalyptus marginata* D.Donn ex Smith) forest is from near Toodyay to Albany, with the western edge of the forest clearly defined by the Darling Scarp and the eastern edge roughly defined by the 750 mm isohyet and forming a dissected line from near New Norcia to Cranbrook (Abbott & Loneragan 1986; Churchward & Dimmock 1989; Dell & Havel 1989). The distribution of jarrah forest is affected primarily by moisture availability and *E. marginata* occurs in pure stands, or in combination or displacement series with other eucalypts across its range, depending on this climatic factor. Although the Jarrah Forest region is clearly demarcated as an IBRA region (Interim Biogeographic Regionalisation for Australia: Thackway & Cresswell 1995), *E. marginata* also extends onto the Swan Coastal Plain, especially in the eastern part, on the foothills of the Darling Scarp. All of the new species described in this paper are found in association with *E. marginata*.

Synaphea diabolica R.Butcher occurs towards the drier eastern edge of the Jarrah Forest region, south-west of York, in mixed eucalypt woodlands comprising combinations of *E. wandoo* Blakely, *E. accedens* W.Fitz., *E. marginata* and *Corymbia calophylla* Lindl., while *S. pandurata* R.Butcher occurs in both mixed *E. marginata*/*C. calophylla* and *E. marginata*/*E. patens* Benth. woodlands, south-east of Perth. By comparison, *S. polypodioides* R.Butcher occurs in mixed *E. marginata*/*C. calophylla*

woodland in a restricted area comprising the foothills and lower relief of the southern Darling Scarp, along the western margin of the Jarrah Forest region, between Dardanup and Donnybrook. *Synaphea trinacriformis* R.Butcher occurs just south of the Northern Jarrah Forest region boundary (IBRA Version 6.1; Department of the Environment and Water Resources 2007) in mixed *E. marginata C. calophylla* woodland east-south-east of Collie (Figure 1).

The Jarrah Forest region occurs on the highly leached, nutrient depleted soils of the extensively laterised landscape forming the Darling Plateau (Dell & Havel 1989). This region experiences a strong west-east gradient of decreasing rainfall, ranging from nearly 1400 mm/annum just east of the Darling Scarp to less than 600 mm/annum at the eastern boundary of the forest (Bell & Heddle 1989). The undulating surface of the Darling Plateau consists of crests (280–320 m above sea level) interspersed with swampy valley floors, interrupted by granite monadnocks (e.g. Mt Cooke, Mt Vincent, Mt Dale) representing remnants of an older, higher plateau, and the landscape is increasingly dissected from east to west, with shallow, swampy, drainage incisions in the eastern part of the plateau giving way to steep-sided valleys on the Darling escarpment (Bell & Heddle 1989; Churchward & Dimmock 1989). The combination of geographic, topographic and edaphic variation throughout the Jarrah Forest has resulted in a complex mosaic of habitats which support a diverse array of floristic communities (Havel 1975a, 1975b; Bell & Heddle 1989; Markey 1997) and a large number of endemic and conservation taxa (Markey 1997; Western Australian Herbarium 1998–; Hopper & Gioia 2004).

Historical, economy-driven threats to the Jarrah Forest and its associated species have included extensive clearing for timber and fuel harvesting, the construction of dams to service the State capital Perth, the development of agricultural land on the eastern and western margins and the mining of bauxite (Havel 1989). The continuing and devastating legacy of this previously unchecked clearing

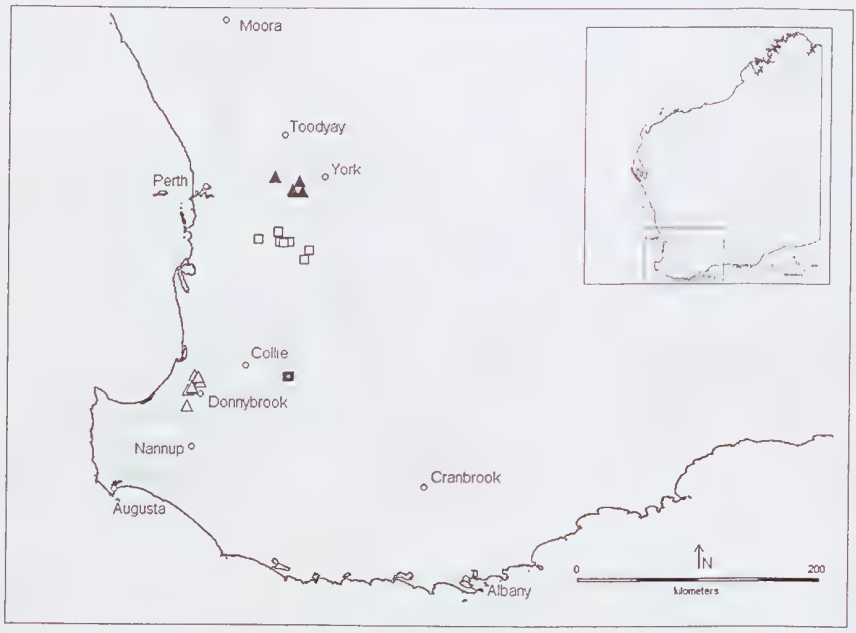

Figure 1. Distribution of *Synaphea diabolica* (▲), *S. pandurata* (□), *S. polypodioides* (△) and *S. trinacriformis* (◘) in the Jarrah Forest region of south-west Western Australia.

is salinisation of the landscape and the spread of jarrah-dieback disease (*Phytophthora cinnamomi* Rands). The clear correlations between clearing and salinity, and ground disturbance (especially road and infrastructure construction) and dieback spread, combined with an increasing demand for recreational access to the jarrah forest, led to comprehensive restrictions on clearing forest within the water catchment area in 1976, followed by the implementation of vegetation surveys and the careful planning and construction of large reserves to balance competing land-use demands and conservation (Conservation Council of Western Australia 1980; Havel 1989).

Today, the area comprising the Northern Jarrah Forest includes large tracts of mixed-use State Forest, much of which is incorporated into limited-access reserves comprising the metropolitan water catchment area. Access to many of these areas is difficult due to issues of land tenure, disease-risk status, infrequent, rough tracks and strict entry regulations, such that it has not been thoroughly explored or exploited by plant collectors, despite its close proximity to Perth. Thus it is that *S. diabolica* was collected for the first time in 1999 by Fred and Jean Hort during their voluntary efforts to survey existing conservation taxa in the region's reserves, and that their collections of *S. pandurata* in 1999 and 2000 allowed the taxonomic status of an anomalous specimen collected by Rob Davis in 1997, to be clarified.

Following George's (1995) treatment of *Synaphea* R.Br, which included a taxonomic key to the 50 species he recognised—greater than five times the number recognised by Bentham (1870)—there has been renewed enthusiasm for collecting members of the genus. This increased collecting effort has resulted in the discovery of many new and putatively new taxa in the last decade, including a number with highly restricted distributions. *Synaphea trinacriformis* and *S. polypodioides* are two such examples, collected for the first time in 1995 and 1996, respectively, with each known only from a localised area within the Jarrah Forest region.

The four new species described here are a diverse assemblage of taxa, exhibiting complex taxonomic relationships with their allies. Systematic and taxonomic work is ongoing in this challenging genus and these species are united in this publication for convenience, due to the pressing need to formalise names and provide descriptions to facilitate effective management of these conservation taxa.

Methods

All *Synaphea* specimens at BM, CANB, K, MEL, NSW, PERTH and UWA have been examined, including type material, or photographs of types, for all names. Measurements of habit, stems and leaves were made from fresh material and herbarium specimens (PERTH & UWA), with floral features measured from material preserved in 70% ethanol and reconstituted flowers. Herbarium acronyms follow Holmgren & Holmgren (1998–) except for CFR. and DKN. which represent the Western Australian regional herbaria at Bunbury (Central Forest Region) and Darkan, respectively.

Leaves of *Synaphea* can differ remarkably across their ontogenetic stages. They are generally entire or fewer-lobed and larger in the juvenile stage or towards the bases of branches, and more highly divided and smaller in the mature stage or towards the branch apices. For consistency of comparison, measurements have been taken from the first three leaves subtending the inflorescences. Leaf length is measured from the apex of the leaf (usually the central terminal lobe) to the start of the petiole, but it is acknowledged here that it can be difficult to determine where the lamina ends and the petiole begins. The petiole is terete to subterete along its length, and is usually channelled in the upper portion in the

transition area between the petiole and the leaf lamina proper. In some species (e.g. *S. pandurata* and *S. polypodioides*), the base of the lamina tapers gradually over a long distance before narrowing into the petiole. Leaf length is therefore measured from the apex of the lamina to the point at which the petiole width becomes constant; the channel may continue along the petiole further below this point. At its base, the petiole expands outward into a sheath, which clasps the stem, and the lower point of the petiole length measurement is taken from the top of the sheath.

As the inflorescences elongate throughout their development, only the longest three spikes have been measured per specimen. Inflorescences at the termination of the growing season may therefore be longer than recorded here. The spacing between flowers can be a useful diagnostic feature, but this has previously been recorded using only qualitative terms such as 'well spaced' or 'crowded' (George 1995). Qualitative terms are retained here but an attempt has been made to quantify this variation by measuring the distances between flowers. As the inflorescences elongate, the spacing between the flowers changes and was therefore measured at two points. Firstly at the base, comprising the distances between the four lowest flowers or empty bracts if flowers have fallen, and secondly at the mid-region, comprising the distances between the upper-most open flower and the three flowers (or empty bracts) below. The distances are presented as a proportion of flower length rather than a numerical value as the degree of spacing is relative and each species has different sized flowers and different inflorescence lengths.

The distribution map was created in DIVA-GIS freeware Version 5.0.2.0 (http://www.diva-gis.org/) using geocode data from PERTH and UWA specimens. The IBRA Version 6.1 boundaries (Department of the Environment and Water Resources 2007) applicable to south-west Western Australia are shown. As these taxa are conservation-listed, locality information has been withheld for all cited specimens.

Taxonomy

Synaphea diabolica R.Butcher, *sp. nov.*

Synapheae damopsis A.S.George et *S. cuneatae* A.S.George affinis, a quibus stigmate late transverse oblongo ad perlate obovato, valde concavo et vaginis pedunculi rubris, glabriusculis differt.

Typus: east of The Lakes, [Shire of] Northam, Western Australia [precise locality withheld forconservation purposes], 14 October 1999, *F. Hort* 666 (*holo*: PERTH 07293909; *iso*: AD, CANB, K, MEL).

Synaphea sp. York (F. Hort 666), Western Australian Herbarium, in FloraBase, http://florabase.dec.wa.gov.au/ [accessed 16 June 2007].

Clumped, sprawling *subshrub*, 0.2–0.6 m tall, 0.5–0.9 m wide. *Stems* numerous from base, 7–120 mm long, woody; bark rough, brown, densely appressed-silky in patches beneath fallen leaf sheaths; upper stems smooth, tomentose and pilose, pink to red-brown; young stems striate, tomentose and pilose, pink-yellow, lightly glaucous. *Leaves* flabelliform, flat to undulate, divided more than half-way into 3 primary lobes, each 1–3 × trilobed; ultimate lobes shortly triangular, 0.5–5 mm long, 1.2–4.3 mm wide; usually acute, pungent, the mucro 0.6–1.1 mm long; *lamina* 43–103 mm long, 36–101 mm wide, lightly to densely pubescent with patent, wavy hairs, glabrescent, concolorous,

dull, pale green, lightly glaucous; reticulation fine, shallow, prominent; main veins raised, slightly more protuberant on abaxial than adaxial surface; juvenile leaves pubescent with moderate to very dense, ascending to patent, wavy hairs, brown to red-brown, sometimes with a gradation in colour from base to apex; *petiole* 25–150 mm long, pubescent with patent, wavy hairs, pilosulose and pilose, glabrescent; *basal sheath* densely appressed pubescent to tomentose abaxially, usually also pilosulose, glabrescent, sometimes lightly glaucous, adaxially densely appressed-silky along mid-line, glabrescent; margins red, ciliate. *Inflorescence* 73–131 mm long at maturity, as long as or up to 1.5 times longer than leaves; flowers ± crowded, the internodes at base of spike 1–5 × perianth length, in mid-region 1/10–1/5 × perianth length; *peduncle* 93–215 mm long, commonly once-branched near base, pubescent to densely pubescent with patent, wavy hairs and pilosulose to densely pilosulose, green, yellow-green and red or red; *basal sheath* 6–12.5 mm long, abaxially appressed pubescent along midline and at apex, soon glabrescent, with appressed apical hairs and ciliate margins, adaxially densely appressed-silky, sometimes with scattered red hairs, glabrescent towards margins, pink-red, orange-red or red; *rachis* pubescent with wavy hairs, yellow-green or red; *bracts* triangular to ovate, spreading, acute to obtuse, 1.4–2.8 mm long, glabrous to pubescent, sometimes only in lower 1/2, abaxially, glabrous adaxially, with prominently ciliate margins. *Perianth* ± horizontal to ascending, opening narrowly, glabrous, lightly puberulous with glabrous apex, or lightly pubescent; *adaxial tepal* curved to strongly curved behind stigma, 5.3–5.8 mm long, 2.5–3 mm wide, the apex erect or angled at *c.* 45°, the margins shortly reflexed towards apex, glabrous or lightly pubescent within concavity; *abaxial tepal* flat or slightly incurved at base, 4.4–5.1 mm long, 1.5–1.8 mm wide, the apex strongly curved forward over anthers then shortly erect for up to 0.1 mm, pubescent behind anthers; *lateral tepals* narrow, angled to side, 4.4–5.2 mm long, 1.7–2.8 mm wide, the apex twisted, sometimes curved forward over anthers, then very shortly reflexed for 0.1–0.2 mm, pubescent behind anthers. *Stigma* ± transversely oblong to very broadly obovate, 1.2–1.3 mm long, 1.4–1.7 mm wide; apex entire to broadly and shallowly emarginate, slightly incurved to incurved; dorsal surface thickened above style attachment; ventral surface thickened and papillose in lower 1/3–1/2, strongly concave above; *style* curved, shortly and strongly hooked at junction with ovary beak; *ovary* cylindrical with adaxially curved puberulous beak to *c.* 0.2 mm long (after style separates), *c.* 0.8 mm long, *c.* 0.5 mm wide, silky; enlarged apical trichomes 30–45, straight, narrow, usually terete, sometimes flattened, translucent to subopaque, 1.1–1.2 mm long. *Fruit* obovoid, smooth with raised venation, 4.5–5.2 mm long, 2.3–3.1 mm wide including a neck 0.6–1.1 mm long, 0.9–1.3 mm wide, pilosulose, dark brown at maturity; beak curved, 0.2–0.3 mm long, puberulous, surrounded by a short, raised apical rim. *Seed* narrowly turbinate, 3–3.5 mm long, 1.7–1.9 mm wide; testa smooth, cream-white, the proximal end covered by membranous pinkish-light brown tissue. (Figure 2)

Specimens examined. WESTERN AUSTRALIA: [localities withheld] 9 Oct. 2000, *R. Butcher & J. Mant* RB 858 (UWA); 10 Oct. 2000, *R. Butcher & J. Mant* RB 859 (PERTH); 6 Oct. 1999, *F. Hort & J. Hort* 643 (PERTH 05481937); 14 Oct. 1999, *F. Hort* 665 (CANB, NSW, MEL, PERTH 07293917); 5 Nov. 1999, *F. Hort* 757 B (PERTH 05900468); 28 Aug. 2000, *F. Hort* 1090 (PERTH 05694655); 28 Aug. 2000, *F. Hort* 1091 (PERTH 05694663).

Distribution. Synaphea diabolica is apparently restricted to an area west and south-west of York (Figure 1).

Habitat. Synaphea diabolica occurs in undulating topography in dry, yellow-brown laterite soil with lateritic gravel in *Eucalyptus wandoo* or mixed *E. accedens*, *E. marginata* and *Corymbia calophylla* open woodland over Proteaceae-rich tall and low shrubland. Associated species include *Dryandra sessilis*, *D. armata*, *D. lindleyana*, *Hakea trifurcata*, *H. ruscifolia*, *H. stenocarpa*, *H. incrassata*, *H. undulata*, *Stirlingia latifolia*, *Synaphea decorticans*, *Grevillea tenuiflora*, *G. scabra*, *G. bipinnatifida*,

Allocasuarina humilis, *Xanthorrhoea preissii*, *Daviesia rhombifolia*, *Lechenaultia biloba*, *Hemigenia viscida*, *Hibbertia hypericoides*, *Acacia pulchella*, *Stenanthemum nanum* and species of *Petrophile*, *Adenanthos*, *Gastrolobium*, *Verticordia* and *Calothamnus*.

Phenology. This species flowers between late August and early November with fruits collected from October.

Conservation status. Recently listed as Priority Two under Department of Environment and Conservation (DEC) Conservation Codes for Western Australian Flora. *Synaphea diabolica* is known from only eight collections occurring across an area of less than 40 km, within the Flynn and Talbot State Forests. This species is not under immediate threat but requires further survey as the specific number and size of populations is not known.

Etymology. The epithet is taken from the Greek word for the Devil (*diabolus*) in reference to the complex taxonomic associations between this taxon and similar species. The name was also inspired by the collection number of the type specimen (*F. Hort* 666).

Affinities. *Synaphea diabolica* is very similar to regional congeners *S. damopsis* A.S.George and *S. cuneata* A.S.George in its spreading habit and cuneate to flabelliform leaf outline, as well as in the pubescent and pilose stems, pubescent leaves and pubescent to pilose peduncles and rachis. These three species also share a pubescent to silky ovary and have pilose, ellipsoidal to obovoid, shortly necked fruits. A distinctive feature of *S. diabolica* is the pink-red colouration of the glabrescent sheaths at the base of the peduncles. While *S. damopsis* and *S. cuneata* have sheaths of a similar colour, they are more densely pubescent so that the colour is usually obscured. The differences between these species lie primarily in the details of leaf morphology, the indumentum and shape of the flowers and stigma morphology.

Typical specimens of *Synaphea damopsis* can be distinguished from *S. diabolica* in having the base of their flabelliform leaves tapering gradually into the petiole as well as in having the primary leaf division up to *c.* one third of the leaf length. By comparison the transition between the leaf lamina and the petiole is more abrupt in *S. diabolica* and the primary leaf division is greater than half of the leaf length. While both species are variable in the indumentum of the perianth, they can be differentiated by the shape and curvature of their flowers and their stigma morphology: *S. damopsis* having a more strongly curved adaxial tepal with strongly reflexed margins and the apex usually reflexed, as well as a trapeziform stigma which is constricted on the sides near the incurved apex. In the shape of its leaves and stigma, *S. damopsis* more closely approximates *S. decumbens* A.S.George.

Synaphea diabolica resembles *S. cuneata* in its dull blue-green, pubescent leaves and leaf shape. While the leaves of *S. cuneata* are typically cuneate with obtuse teeth on the upper margin and those of *S. diabolica* are wider relative to length and have the primary division greater than half of the leaf length, specimens of *S. cuneata* with deeply divided leaves (e.g. *A.S. George s.n.*, PERTH 04868331; *F. Hort, J. Hort & R. Butcher* 660, PERTH 06744893) have also been collected. These two species can be distinguished, however, by the shape and indumentum of their flowers and their stigma morphology: *S. cuneata* having more widely opening, pilosulose, flowers with greater reflexion to the tepal apices and a stigma which is transversely lunate with divergent lobes or short horns. Some specimens of *S. cuneata* with a more prominently horned stigma and larger, more pubescent flowers (e.g. *F. & B. Hort* 2407, PERTH 06924719) approach *S. floribunda* A.S.George.

Figure 2. Holotype of *Synaphea diabolica* (*F. Hort* 666), scale = 5 cm.

Synaphea xela R.Butcher, a recently-described taxon from the Jurien Bay to Eneabba area, has some similarity with *S. diabolica* in habit, gross leaf morphology and stigma shape (see Butcher 2006), but can be distinguished by the folded, more deeply divided leaves with prominently mucronate apices, sparsely pubescent peduncle and rachis, consistently glabrous flowers with the adaxial tepal strongly curved and with strongly flared margins, and the ovary glabrous or glabrescent at the apex.

Notes. The majority of spikes in *F. Hort* 665 have anomalous flowers comprised of four ± equal-sized tepals, each resembling a typical abaxial tepal in shape and in the possession of two fertile anther locules. Many of these flowers are apparently cleistogamous, but developing and fully-formed fruits can be found towards the base of the spikes, indicating that self-fertilisation may be occurring.

Synaphea pandurata R.Butcher, *sp. nov.*

Ad speciebus aliis omnibus turma sequenti characterum distinguitur: folia glabra, veneta, profunde lobata; petioli glabri; perianthium glabrum tepalo adaxiali valde curvato; stigma panduratum, concavum; ovarium dimidio superiore glabriusculum.

Typus: south of Brookton Hwy [Beverley Shire], Western Australia [precise locality withheld for conservation purposes], 23 October 1999, *R. Butcher, F. Hort & J. Hort* RB 800 (*holo*: PERTH 07482051; *iso*: CANB, K, MEL, NSW).

Synaphea sp. Perimeter Rd (R. Davis 4151A), in G. Paczkowska & A.R. Chapman, West. Austral. Fl.: Descr. Cat. p. 505 (2000).

Clumped *subshrub* 0.20–0.55 m tall, 0.2–0.8 m wide. *Stems* numerous from base, 20–100 mm long, with numerous branches arising at yearly growth increment nodes; older stems with brown bark, glabrescent; younger stems striate, almost glabrous to appressed pubescent, yellowish-pink to pink-red, ± glaucous. *Leaves* rarely simple, usually broadly three-lobed to pinnatipartite, the base usually gradually tapering into petiole, ± flat to gently undulate at apex; lowest pair of lobes simple to twice trilobed; ultimate lobes linear-oblanceolate to rounded, 5–18 mm long, 3–11 mm wide; obtuse to rounded with a very short, blunt mucro 0.2–0.5 mm long; *lamina* 50–100 mm long, 45–95 mm wide, glabrous, concolorous, dull, pale bluish-green, lightly glaucous; reticulation fine, shallow, subdued; main veins raised, ± equally protuberant on adaxial and abaxial surfaces; juvenile leaves red-brown beneath white pubescence, soon glabrescent; *petiole* 50–155 mm long, glabrous to sub-glabrous, appressed-pubescent at base just above sheath, lightly glaucous; *basal sheath* sparsely pubescent to densely appressed-pubescent abaxially, densely appressed-silky adaxially; margins pink-red, ciliate. *Inflorescence* 40–195 mm long at maturity, as long as or up to 2 times longer than leaves; flowers crowded, the internodes at base of spike 2–10 × perianth length, in mid-region 1/7–1/2 × perianth length; *peduncle* 85–320 mm long, twice- to thrice-branched, sparsely puberulous to pubescent with hairs denser towards base, green infused with red to red; *basal sheath* 8–9.5 mm long, glabrous to finely and densely appressed-pubescent abaxially, densely appressed-pubescent adaxially, light brown with margins and apex reddish to red; *rachis* lightly pubescent, yellowish-green infused with red; *bracts* ovate to broadly triangular, spreading, obtuse, 1–2.2 mm long, glabrous to sparsely pubescent in lower 1/2 and along midline abaxially, glabrous adaxially, with shortly ciliate margins. *Perianth* horizontal to gently ascending, opening moderately to widely, glabrous, rarely sub-glabrous; *adaxial tepal* very strongly curved behind stigma, 4.4–5.6 mm long, 2–2.8 mm wide, the apex erect to reflexed (angled at 30–45°), the margins very shortly reflexed to reflexed, hairs present within concavity; *abaxial tepal* ± flat, 3–4.2 mm long, 1.25–1.65 mm wide, the apex curved forwards over anthers then shortly and

strongly reflexed for 0.2–0.3 mm, hairs present behind filament and anthers; *lateral tepals* ± straight, 3.1–4.7 mm long, 1.5–2.2 mm wide, the apex angled to side then shortly and strongly reflexed for 0.3–0.5 mm, hairs present behind filament and anthers. *Stigma* ± quadrate, slightly expanded at base, to pandurate, with sides constricted in mid-region to upper 1/3, 0.8–1.4 mm long, 0.9–1.3 mm wide; apex entire to shallowly emarginate, incurved; dorsal surface with very thick longitudinal ridge in lower 2/3 or to apex; ventral surface thickened and papillose in lower 1/3–1/2, strongly concave above; *style* geniculate; *ovary* broadly ellipsoid to spheroid with small, truncate mostly glabrous, adaxially angled beak to *c.* 0.2 mm long (after style separates), 0.6–1 mm long, 0.5–0.7 mm wide, glabrous in upper 2/3–1/3 and appressed-finely silky below or pubescent throughout, hairs often sparser towards apex; enlarged apical trichomes 15–30, broad, spathulate and flattened to narrow, straight and subterete, frequently kinked at base, 0.5–0.9 mm long, translucent. *Fruit* cylindrical to obovoid, tapering into short, thick neck, ± smooth, 4.3–5.4 mm long, 2.3–2.6 mm wide including a neck 0.5–1.1 mm long, 1.1–1.2 mm wide, sparse, short hairs in lower 1/3–2/3, or throughout, golden brown to dark olive green; beak erect, *c.* 0.2 mm long, mostly glabrous, puberulous at base, surrounded by a small apical rim. *Seed* not seen. (Figure 3)

Specimens examined. WESTERN AUSTRALIA: [localities withheld] 23 Oct. 1999, *R. Butcher, F. Hort & J. Hort* RB 803 (AD, PERTH); 23 Oct. 1999, *R. Butcher, F. Hort & J. Hort* RB 804 (PERTH); 23 Oct. 1999, *R. Butcher, F. Hort & J. Hort* RB 806 (PERTH); 23 Oct. 1999, *R. Butcher, F. Hort & J. Hort* RB 807 (PERTH); 23 Oct. 1999, *R. Butcher, F. Hort & J. Hort* RB 811 (CANB, MEL, PERTH); 17 Sep. 1997, *R. Davis* 4151 A (NSW, PERTH 04938976); 23 Oct. 1999, *F. Hort, J. Hort & R. Butcher* 658 (AD, BM, BRI, CANB, DNA, HO, K, MEL, NSW, NY, PERTH 05540186); 29 Oct. 1999, *F. Hort, J. Hort & R. Butcher* 711 (AD, CANB, DNA, K, KPBG, MEL, PERTH 05534275); 29 Oct. 1999, *F. Hort, J. Hort & R. Butcher* 713 (AD, BM, NY, PERTH 05534267); 23 Oct. 1999, *F. Hort, J. Hort & R. Butcher* 714 (MEL, PERTH 05534283); 17 Apr. 2000, *F. Hort* 995 (PERTH 05586577); 1 June 2000, *F. Hort* 1039 (PERTH 05604958); 6 Sep. 2006, *F. & B. Hort* 2859 (CANB, MEL, NSW, PERTH 07486146); 28 Oct. 1999, *L. Robson s.n.* (NSW, PERTH 05481910).

Distribution. Only recently collected from the east side of the Darling Range, west and south-west of Brookton (Figure 1).

Habitat. Most collections have been made in mixed *Eucalyptus marginata/Corymbia calophylla* open woodland from yellow-grey, yellow-brown or yellow-red sands and sandy loams, with some lateritic gravel, over an undulating granite substrate. Associated species from jarrah-marri woodland sites include *Banksia grandis, Xanthorrhoea preissii, Sphaerolobium medium, Lechenaultia biloba, Bossiaea ornata, Stirlingia latifolia, Hibbertia hypericoides, Tetratheca hirsuta, Dryandra sessilis, D. squarrosa, Daviesia rhombifolia, D. decurrens, Hakea cyclocarpa, H. ruscifolia, Grevillea tenuiflora, Stenanthemum nanum, Petrophile teretifolia, Pericalymma ellipticum* and *Pultenaea pauciflora. Synaphea pandurata* has also been collected from the edge of a granite sheet in open jarrah woodland abutting proteaceous heath dominated by *Grevillea bipinnatifida, Hakea trifurcata, H. undulata, H. incrassata, Persoonia quinquenervis* and *Allocasuarina humilis*. In addition, one collection has been made from open *E. marginata/E. patens* woodland with scattered *Melaleuca preissiana* in a low-lying area near the base of Mt Vincent, with mosaic soils of dark brown loam and yellow-brown loamy gravel. Associated vegetation at this site included many species common to the jarrah-marri woodland and proteaceous heath as well as *Mesomelaena tetragona, Hypocalymma angustifolium* and *Grevillea wilsonii*.

Phenology. Flowering material of *Synaphea pandurata* has been collected mostly in September and October, but an anomalous early flowering collection was made in April 2000 after an unseasonably wet summer (*F. Hort* 995). Fruits have been collected in October.

Figure 3. Holotype of *Synaphea pandurata* (*R. Butcher, F. Hort & J. Hort* RB 800), scale = 5 cm.

Conservation status. Recently listed as Priority Three under DEC Conservation Codes for Western Australian Flora. *Synaphea pandurata* has a restricted geographic distribution and is poorly known, although the majority of collections are from protected areas within the Water Authority's metropolitan catchment area (i.e. Flint State Forest, Wearne State Forest and Lupton Conservation Park).

Etymology. The epithet *pandurata* refers to the fiddle-shaped (pandurate) stigma.

Affinities. *Synaphea pandurata* has similarities to a number of regional congeners including *S. decorticans* Lindl., *S. boyaginensis* A.S.George, *S. damopsis* and *S. polypodioides*, as well as the more northern species *S. panhesya* A.S.George and *S. grandis* A.S.George. Close relationships are hypothesised to exist among these taxa.

Synaphea pandurata shares its dull, blue-green, deeply lobed leaves with *S. decorticans* and *S. boyaginensis*, but can be differentiated from both of these species by the shape of its flowers and stigma. *Synaphea decorticans* possesses large, widely opening flowers with a more or less quadrate to transversely lunate stigma and a puberulous ovary which develops into an ellipsoidal fruit positioned abruptly on a short neck. By comparison, *S. pandurata* has moderately opening flowers, a stigma with constricted sides and an ovary which is glabrous towards the apex and develops into a cylindrical to obovoid fruit which tapers into the neck. *Synaphea boyaginensis* can be distinguished by its large, very swollen, narrowly opening flowers with a large, ovate stigma that has the ventral surface angled and papillose in the lower half and strongly concave in the upper half with a strongly incurved apex, as well as its silky ovary. The petioles of *S. decorticans* also distinguish it from *S. pandurata*, being pinkish at the base above the leaf sheaths and having scattered pilose hairs, whereas those of *S. pandurata* are uniformly dull green and lack pilose hairs.

Synaphea pandurata is similar to *S. polypodioides*, a close relative of *S. boyaginensis*, in its thin textured, deeply divided leaves with usually broad ultimate lobes, as well as in its glabrous flowers and the pubescence of its ovary. The two species can be distinguished by their leaf colour and the shape of their flowers and stigma, and these features are discussed in detail under *S. polypodioides*. *Synaphea damopsis* is a species growing in the same geographic area which has similar shaped flowers, similar curvature to the adaxial tepal and similar stigma morphology (i.e. the stigma is concave ventrally with a prominent longitudinal ridge on the dorsal surface and has constricted sides, although the constriction is further towards the narrower apex in this species). In both taxa the leaf lamina may taper gradually into the petiole, but this character is more pronounced in *S. damopsis*, which can be easily distinguished by its darker green, frequently pilose leaves which are more or less flabelliform in outline and undulate, with short, triangular ultimate lobes.

Leaf colour and form is also similar to *S. panhesya*, a Bindoon area endemic closely affiliated with *S. decorticans*, and the stigmas of *S. pandurata* and *S. panhesya* are similar in size (0.8–1.4 × 0.9–1.3 mm compared with 0.7–1.2 × 0.8–1.3 mm in *S. panhesya*) and general appearance—*S. panhesya* having a trapeziform to obtrapeziform, through transversely broad-oblong, stigma with a shallowly emarginate and slightly incurved apex, the ventral surface slightly concave in the upper half and the dorsal surface with a thickened ridge in the lower half to three quarter length. The strongly constricted sides to the stigma and the more concave ventral surface distinguish *S. pandurata*, however. *Synaphea panhesya* can be distinguished by its more horizontally oriented, narrowly opening flowers, which have less curved adaxial tepals and a villous ovary. *Synaphea grandis* is similar in having flowers with a curved adaxial tepal and concave stigma, but the flowers are much larger. Additional distinguishing features of *S. grandis* are discussed under the affinities of *S. polypodioides*.

Notes. Specimens collected from lateritic rises and upslope localities (e.g. *R. Butcher* RB 811; *R. Davis* 4151 A) have more highly divided leaves with narrower ultimate lobes and slightly smaller flowers, but match other collections in the shape and curvature of the flowers and stigma as well as in indumentum.

R. Butcher RB 804 has broader leaves with broader ultimate lobes and large flowers in which the adaxial tepal is more rounded in outline than usual, the abaxial tepal is more elongate and the stigma is more quadrate with less constricted sides. This collection may represent a hybrid with *S. decorticans*.

Anomalous collections include *R. Butcher* RB 806 (PERTH) and RB 807 (PERTH) which have their flowers scarcely opening to opening narrowly and which have additional, half- to fully-formed anthers on the adaxial and lateral tepals. Although the flowers are anomalous, the leaves and fruits are the same as other specimens of *S. pandurata* and this variation is regarded as a developmental mutation. These two collections were made from a granite sheet, just inside an area of proteaceous shrubland surrounded by jarrah woodland.

Synaphea polypodioides R.Butcher, *sp. nov.*

Synapheae boyaginensis A.S.George affinis, sed foliis fusco-viridibus, texturis tenuibus, minus divisis, lobatis minus profundis, lobis latioribus.

Typus: north-north-west of Donnybrook, Western Australia [precise locality withheld for conservation purposes], 20 October 1998, *R. Butcher & B. Hartmann* RB 573 (*holo*: PERTH 07482078; *iso*: CANB, K, MEL).

Synaphea sp. Donnybrook (B.J. Lepschi & T.R. Lally BJL 3111), Western Australian Herbarium, in FloraBase, http://florabase.dec.wa.gov.au/ [accessed 16 June 2007].

Clumped *subshrub* 0.35–0.4 m tall, 0.4–0.8 m wide; tap root very slender with smooth, dark brown bark on main and lateral roots. *Stems* numerous from base, 5–90 mm long, often with distinct internodes representing yearly growth increments on upper stems; older stems with brown bark, base mostly concealed by overlapping remnant leaf bases, with some appressed hairs; younger stems striate, glabrous with appressed hairs near junctions with sheaths, reddish brown. *Leaves* simple, three-lobed or pinnatipartite, with ± asymmetric divisions, the base usually gradually tapering into petiole, flat to slightly undulate; lowest pair of lobes simple to trilobed, straight or curved downwards; ultimate lobes linear, oblong or oblanceolate, (11–18)26–90 mm long, 4–16 mm wide; obtuse, scarcely mucronate; *lamina* (54)75–175 mm long, 46–165 mm wide, thin textured, glabrous to sub-glabrous, sparsely puberulous on main veins, concolorous to slightly discolorous, light to mid green, ± glaucous; reticulation fine to moderately open, shallow, prominent, main veins raised, ± equally protuberant on adaxial and abaxial surfaces; juvenile leaves puberulous, soon glabrescent, red-brown; *petiole* 20–105 mm long, sub-glabrous to sparsely appressed-puberulous, occasionally lightly glaucous; *basal sheath* ± glabrous with appressed hairs at apex and base abaxially, densely appressed-silky adaxially; margins orangey-pink, ciliate, glabrescent. *Inflorescence* 45–250 mm long at maturity, 0.5–3 times longer than leaves; flowers openly spaced with rachis elongating, the internodes at base of spike 5–10 × perianth length, in mid-region 1–5 × perianth length; *peduncle* 100–410 mm long, broad, distinctly flattened and striate at base, once- to thrice-branched, sub-glabrous to appressed-pubescent, pubescent at base, green, green and red or red; *basal sheath* 5.5–8.5 mm long, pubescent at apex and along midline abaxially, densely

appressed-silky adaxially, pinkish light brown to red-brown; *rachis* sparsely to densely pubescent, green, green and red or red; *bracts* triangular to broadly ovate, spreading, obtuse, 1.7–2.6(3.4) mm long, glabrous to lightly pubescent abaxially, glabrous adaxially, with ciliate to densely ciliate margins, cilia densest in upper 1/2. *Perianth* gently ascending to ascending, opening moderately to widely, glabrous or sub-glabrous to sparsely pubescent; *adaxial tepal* very strongly curved behind stigma, especially near base, 5.6–6.8 mm long, 2.6–3.2 mm wide, the apex ± erect, slightly hooded forwards or angled back at *c.* 45°, the margins gently and shortly reflexed, glabrous to sparsely puberulous in lower 1/2 of concavity; *abaxial tepal* flat to slightly convex, 4.75–5.6 mm long, 1.8–2.1 mm wide, the apex narrow, strongly curved forwards over anthers then reflexed for 0.3–0.75 mm, hairs present behind filament; *lateral tepals* straight to angled to side, 4.5–5.4 mm long, 2.15–2.7 (3.1–3.7) mm wide, the apex incurved then twisted and reflexed to side over 0.3–0.6 mm, hairs present behind filament. *Stigma* ovate with sides constricted and narrowed towards apex, 2–2.65 mm long, 1.35–1.75 mm wide; apex narrow, shallowly emarginate, incurved; dorsal surface with thick, narrow, longitudinal ridge terminating just below incurved apex; ventral surface thickened and papillose in lower 1/3–2/3, strongly concave above; *style* attached *c.* halfway along dorsal surface of stigmatic plate, straight, arcuate adaxially or geniculate at attachment with ovary beak; *ovary* ovoid to cylindrical with a ± conical, adaxially angled, puberulous at base but glabrous above, beak to 0.2–0.3 mm long (after style separates), 1.6–1.9 mm long, 1.3–1.5 mm wide, glabrous with fine hairs just at base to lightly pubescent with hairs sparser, glabrescent, in upper 1/2; enlarged apical trichomes 15–30, spathulate to oblanceolate with thick walls, subterete, straight to strongly curved, 0.6–0.9 mm long, translucent to opaque. *Fruit* (not fully mature) cylindrical to obovoid, tapering into a slender to broad neck, ± smooth, 5.4–5.8 mm long, 2.6–3.1 mm wide including a neck 0.7–1.5 mm long, *c.* 0.7 mm wide, glabrous with fine hairs at base and apex to sparsely pubescent with hairs concentrated at base, golden brown; beak scarcely protruding to shortly triangular, angled adaxially, 0.1–0.2 mm long, puberulous, surrounded by a short apical rim. *Seed* not seen. (Figure 4)

Specimens examined. WESTERN AUSTRALIA: [localities withheld] 31 Oct. 2003, *R. Butcher* RB 920 (PERTH 07215428); 20 Oct. 1998, *R. Butcher & B. Hartmann* RB 574 (PERTH); 20 Oct. 1998, *R. Butcher & B. Hartmann* RB 575 (HO, NSW, PERTH); 20 Oct. 1998, *R. Butcher & B. Hartmann* RB 577 (PERTH); 29 Sep. 2000, *R.J. Cranfield* 15341 (CFR., PERTH 05350301); 29 Nov. 2001, *R.J. Cranfield* 17623 (CFR., PERTH 06050689); 9 Oct. 2005, *S.A. Fisher* BNC 567 (CFR., PERTH 07418027); 31 Oct. 1998, *P.C. Jobson, P.H. Weston & J.M. Wilson* PCJ 6051 (PERTH 06784437, NSW, NY); 13 Oct. 1996, *G.J. Keighery* 14538 (PERTH 04951336); 18 Oct. 1996, *B.J. Lepschi & T.R. Lally* BJL 3111 (AD, CANB, MEL, PERTH 04939883).

Distribution. This species is restricted to the Dardanup – Donnybrook region, *c.* 180 km south of Perth (Figure 1).

Habitat. Synaphea polypodioides grows in light brown loam, red-brown sandy loam and gravelly, brown, sandy clay soils over laterite in undulating topography. The species occurs in *Corymbia calophylla/Eucalyptus marginata* open woodland and forest with a shrubby understorey comprising *Persoonia longifolia, Agonis flexuosa, Pteridium esculentum, Chorizema ilicifolia, Macrozamia riedlei* and species of *Boronia, Adenanthos, Grevillea, Conostylis, Acacia, Hibbertia, Dampiera* and *Xanthorrhoea.* At one locality east of Dardanup *S. polypodioides* has been collected from white-grey sand over colluvial sand in *E. marginata* woodland over *Banksia attenuata* low woodland.

Phenology. Synaphea polypodioides has been collected in flower in September and October, with fruiting commencing in October.

Figure 4. Holotype of *Synaphea polypodioides* (*R. Butcher & B. Hartmann* RB 573), scale = 5 cm.

Conservation status. Recently listed as Priority Three under DEC Conservation Codes for Western Australian Flora. Small populations of *S. polypodioides* have been found in remnant woodland throughout the Boyanup – Donnybrook area and large populations exist in jarrah woodland south-west of Donnybrook. The geographic extent of this species appears small.

Etymology. The epithet refers to the leaves of this species which are thin-textured and similarly divided to some species of the fern genus *Polypodium*. The name also pays homage to the nomenclatural fame of *Synaphea spinulosa* (Burm.f.) Merr. in being one of the first two Australian plants named under the Linnaean binomial system; albeit as *Polypodium spinulosum* Burm.f.

Affinities. *Synaphea polypodioides* is most similar to *S. boyaginensis* and *S. pandurata* in its foliage, floral and fruit characters, and a close relationship between them is hypothesised. In particular, all three species have large numbers of branches arising at stem nodes, flowers which have a strongly curved adaxial tepal and a stigma which is strongly concave ventrally. The stigma of *S. pandurata* is distinctive in this group of species in being flatter ventrally, more quadrate in outline and prominently constricted along the sides in the mid-region. *Synaphea polypodioides* is more similar to *S. boyaginensis* in both floral and stigma morphology, differing primarily in leaf form, having less frequently, and less deeply, divided, greener, thinner-textured leaves with usually broader, more or less oblong ultimate lobes. By comparison the leaves of *S. boyaginensis* are highly dissected, pinnatipartite and blue-green, with rigid, slender, linear to narrowly triangular ultimate lobes, and are rough to the touch due to the raised reticulating veins. One specimen of *S. polypodioides* (*R. Butcher* RB 920), approaches *S. boyaginensis* (especially collections from Gunapin State Forest) in the pale, glaucous appearance to the leaves and the narrower width of the ultimate lobes, but the leaves were dark, dull green when fresh and are thin-textured. *R. Butcher* RB 920 is an upland collection and this taxon may be exhibiting the same patterns of environmental leaf variation noted for *S. pandurata*.

R.J. Cranfield 17623 differs from other specimens of *S. polypodioides* in being hairier throughout and this specimen is recorded as being from a slightly different habitat (sandy clay soils near a watercourse in *Corymbia calophylla* forest). Although the effect of habitat on morphology within this species has not been investigated, it appears significant that *S. polypodioides* and *S. boyaginensis* are biogeographically distinct and have different habitat preferences. While both taxa occur in lateritic uplands, *S. polypodioides* is found further down slope in sandier and loamier soils than *S. boyaginensis*. Additionally, where *S. polypodioides* is found in *Eucalyptus marginata*, *C. calophylla* and *Banksia grandis* woodland, over a primarily herbaceous understorey, on the southern tail of the Darling Scarp, *S. boyaginensis* is found in low woodland characterised by *E. wandoo*, *E. accedens* and *E. drummondii*, over proteaceous shrubland and heath, in lower rainfall areas on the eastern edge of the Jarrah Forest region, on the Darling Plateau.

Synaphea polypodioides is similar to *S. pandurata* in having the ovary more or less glabrous, with hairs just at the base or in the lower third, and, like this species, has occasional individuals with a lightly pubescent ovary (i.e. *R.J. Cranfield* 17623). Collections with a pubescent ovary are more likely to be confused with *S. boyaginensis* as this latter species has a silky ovary. Although there is an overlap in total leaf width and ultimate lobe width values between *S. polypodioides* and *S. pandurata*, and each species has relatively thin-textured leaves, those of the former are more green than blue-green in colour and more irregularly lobed. *Synaphea polypodioides* can also be distinguished by its less branched habit with fewer branches arising from nodes, its larger flowers in which the apices and margins of the tepals are not as strongly reflexed and its stigma, which is longer, broader and less constricted at the sides, with a narrowed, incurved apex.

Synaphea polypodioides also bears some similarity to *S. grandis* and *S. whicherensis* A.S.George in flower and stigma morphology, but more closely resembles *S. grandis* in leaf morphology and clumped habit. Although variable across its range, the divisions of the leaves of *S. grandis* usually diverge at greater angles and have triangular to narrowly triangular ultimate lobes with a longer apical mucro. The flowers are usually larger, with a greater L:W ratio to each tepal, the adaxial tepal is less curved dorsally and has margins that are more strongly reflexed, while the apex of the abaxial tepal is erect then gently incurved, rather than curved forwards then reflexed. *Synaphea grandis* can be distinguished by its more or less oblong stigma which has a strongly incurved, shortly emarginate apex and which is scarcely papillose in the lower half of the ventral surface, as well as by its puberulous to pubescent ovary.

Synaphea whicherensis is similar in its floral shape, strongly curved adaxial tepal, concave stigma and an ovary that is more or less glabrous except for fine hairs at the base, but is easily distinguished by both leaf and stigma morphology. The flowers of *S. whicherensis* are described as being 'swollen' (George 1995) and have the apex of the abaxial tepal strongly recurved and more or less appressed to the dorsal surface of the tepal. While both species have a concave stigma, that of *S. whicherensis* is entire with a rounded apex that is not incurved. *Synaphea whicherensis* can also be distinguished by its distinctly narrow-linear (2–4 mm wide) leaf lobes which are frequently curved downwards and have acuminate, pungent apices. Although *S. whicherensis* has long peduncles (140–185 mm long) the spikes are distinctive in being short (20–48 mm long) with the flowers very crowded at the apex.

Synaphea trinacriformis R.Butcher, sp. nov.

Ab speciebus aliis omnibus turma sequenti characterum distinguitur: folia lanceolata vel obovata vel anguste cuneata, crassa, foveata; perianthium pilosum tepalis lateralibus valde falcatis; stigma manifeste cornutum projectura erecta apicali ex paginae ventrali orienti.

Typus: south-east of Bowelling, Western Australia [precise locality withheld for conservation purposes], 2 October 1999, *R. Butcher, J.A. Wege & D.T. Wildy* RB 780 (*holo*: PERTH 07482035; *iso*: CANB, K, MEL, NSW).

Synaphea sp. Bowelling (R. Butcher & B. Hartmann RB 608), Western Australian Herbarium, in FloraBase, http://florabase.dec.wa.gov.au/ [accessed 16 June 2007].

Prostrate *subshrub* 0.15–0.3 m tall, 0.2–1 m wide. *Stems* few, 50–140 mm long; older stems with brown bark and scattered appressed hairs; younger stems densely pubescent and pilose. *Leaves* lanceolate, obovate or narrowly cuneate, entire to shortly three-lobed at apex, the latter sometimes shortly three-lobed again, ± flat to gently concave, undulate towards apex; ultimate lobes triangular, 2–14 mm long, 3–6 mm wide; obtuse with an acute to obtuse, ± sharp mucro 0.2–0.9 mm long; *lamina* 60–145 mm long, 8–47 mm wide, puberulous to densely pubescent and sparsely to densely pilose, concolorous to very slightly discolorous, pale green when fresh, drying yellowish-green, not glaucous; reticulation fine and pitted, reticulum thickened; midvein and two marginal veins raised and prominent, more protuberant on abaxial than adaxial surface; juvenile leaves with pitted reticulation, densely pubescent and pilose, yellowish-green to pale green; *petiole* 25–150 mm long, densely puberulous to pubescent and pilose throughout; *basal sheath* densely pubescent and pilose abaxially, densely appressed-silky adaxially; margins pale pinkish-cream, ciliate, but mostly obscured by vestiture. *Inflorescence* 30–135 mm long at maturity, just shorter than or up to 0.5 times longer than leaves; flowers crowded, the internodes at base of spike 1–3 × perianth length, in mid-region 1/3–1/2

× perianth length; *peduncles* 10–110 mm long, simple or rarely once-branched, densely pubescent and pilose throughout, with scattered red, resinous hairs, green when fresh, drying yellowish-green; *basal sheath* 11–18 mm long, puberulous to appressed-pubescent with pilose hairs along margins and centre line to appressed-silky throughout, with scattered red hairs abaxially, sparse to dense appressed hairs along centre line and at apex, margins glabrous adaxially, cream infused with pink when fresh, light reddish-brown when dried; *rachis* densely pubescent and pilose, green when fresh, yellowish-green when dried; *bracts* ovate to broadly ovate, spreading horizontally with base sheathing flower, acute to broadly obtuse, 2–3.2 mm long, densely pubescent and spreading pilosulose to pilose abaxially, glabrous adaxially, with long ciliate margins. *Perianth* ± horizontal to gently ascending, opening moderately to widely, compressed dorsiventrally, patently pubescent; *adaxial tepal* curved at base below stigma, ± flat towards apex, 4.8–6.5 mm long, 2.8–3.6 mm wide, the apex erect to gently curved forwards, the margins flared backwards to shortly and strongly reflexed, glabrous or with scattered, short, white and red hairs within shallow concavity; *abaxial tepal* ± flat to strongly convex, 3.1–4.3 mm long, 1.2–1.7 mm wide, the apex shortly and strongly reflexed for 0.5–0.7 mm, few hairs present mostly behind filament; *lateral tepals* ± falcate, 3–4.7 mm long, 2–3.4 mm wide, the apex strongly curved to the side and reflexed for 0.5–0.7 mm, few hairs present mostly behind filament. *Stigma* broadly ovate with erect to divergent horns, 1.2–1.6 mm long, 1.5–2 mm wide, including horns 0.6–1 mm long; apical horns reflexed then erect to gently incurved; dorsal surface evenly thickened from base to apex; ventral surface reclining, convex on the horizontal plane, with an erect, apical, triangular projection 0.3–0.5 mm long held between the horns; *ovary* cylindrical with a broad, obtuse, sparsely puberulous beak to 0.2–0.3 mm long (after style separates), 0.5–0.9 mm long, 0.5–0.7 mm wide, appressed-silky; enlarged apical trichomes 23–41, spathulate, flattened, 0.5–1.1 mm long, translucent. *Fruit* obovoid, with a thickened ridge on the adaxial edge in the lower 2/3, almost sessile, smooth with venation lightly rugulose to netted, 3.9–4 mm long, 2.6–2.7 mm wide, including a minute neck 0.2–0.3 mm long, 0.7 mm wide, pilosulose, light greenish-brown (not fully mature); beak broadly conical, 0.4–0.5 mm long, 0.8–1.2 mm wide, glabrous, apical rim of fruit scarcely discernable. *Seed* not seen. (Figure 5)

Specimens examined. WESTERN AUSTRALIA: [localities withheld] 22 Oct. 1998, *R. Butcher & B. Hartmann* RB 608 (PERTH 05300398); RB 609 (AD, PERTH 05300371); 12 May 1998, *R. Davis* 6202 (PERTH 05107423); 17 Nov. 1997, *R. Davis* 4480 (PERTH 04936159); 25 Sep. 1995, *V. Crowley* DKN 145 (DKN., PERTH 04726235).

Distribution. *Synaphea trinacriformis* has been collected from a single area near Bowelling, *c.* 35 km east-south-east of Collie (Figure 1). Although its distribution appears restricted at this stage, populations are large and healthy with plants from the type locality being abundant *c.* 5 years post-fire.

Habitat. This species has been collected from both roadside and undisturbed sites in soils comprising bare white sand to grey-brown loamy sand and laterite gravel. Associated vegetation is low, open woodland dominated by *Eucalyptus marginata* and *Corymbia calophylla* with *Allocasuarina* sp., *Banksia attenuata* and *Banksia grandis* as sub-dominant species. Understorey vegetation includes *Xanthorrhoea preissii* and species of *Lechenaultia*, *Persoonia*, *Gompholobium*, *Calytrix* and *Bossiaea*.

Phenology. Flowering specimens have been collected in September and October, and fruits have been seen in mid-November (*R. Davis* 4480).

Conservation status. Recently listed as Priority One under DEC Conservation Codes for Western Australian Flora. *Synaphea trinacriformis* is known from only five collections within a small geographic area, none of which is within a current conservation reserve.

Figure 5. Holotype of *Synaphea trinacriformis* (*R. Butcher, J.A. Wege & D.T. Wildy* RB 780), scale = 5 cm.

Etymology. The epithet *trinacriformis* is Latin for 'three-pronged' and refers to the trident-like appearance of the stigma.

Affinities. *Synaphea trinacriformis* is closely affiliated with *S. brachyceras* R.Butcher and *S. favosa* R.Br., all these species being prostrate to domed sub-shrubs with pitted leaf reticulation, overlapping flower sizes and prominent stigmatic horns. Of these, *S. brachyceras* is most similar as it also has a shorter apical projection between the stigmatic horns, although this arises from the dorsal surface of the stigma and is recurved, while it is an erect extension of the ventral surface in *S. trinacriformis*. Although there is some overlap in leaf morphology when each of these species has entire leaves, those of *S. brachyceras* are generally more divided, ranging from deeply tripartite to pinnatipartite (Butcher 2000), while those of *S. trinacriformis* are either entire or very narrowly cuneate in outline with short, triangular lobes at the apex. *Synaphea trinacriformis* is also more pubescent throughout, with dense short pubescence and pilose hairs on its petioles and peduncles, and more pubescence on bracts and flowers. *Synaphea favosa* can be easily distinguished from both *S. trinacriformis* and *S. brachyceras* by the absence of a projection between the stigmatic horns.

In its prostrate habit, leaf shape, dense pubescence on petioles and peduncles, and horned stigma, *Synaphea trinacriformis* is also similar to *S. hians* A.S.George, *S. floribunda* and *S. reticulata* (Sm.) Druce. The former two species can be distinguished by the shallow reticulation on their leaves, where the reticulating veins are barely raised above the lamina, as well as their longer bracts (3–6 mm long and 3–3.5 mm long respectively), larger flowers (adaxial tepal 6.5–7.5 mm long and 6–6.5 mm long respectively) and the absence of an apical projection between the longer stigmatic horns. *Synaphea reticulata* has more prominent reticulation on the leaves, and bract and adaxial tepal lengths overlap with those of *S. trinacriformis*, but the lamina is distinctly pitted in this latter species, the abaxial tepals are shorter (4.5–5.8 mm long compared with 3.1–4.1 mm long in *S. trinacriformis*) and the stigmatic projection is distinctive.

Notes. Of the taxa discussed above, all but *S. brachyceras* are members of *Synaphea* sect. *Bicornis* A.S.George (see Butcher 2000) and *S. trinacriformis* would also be placed here based on leaf and stigma morphology. However, I regard the infrageneric classification of *Synaphea* as unstable and do not formally place *S. trinacriformis* within sect. *Bicornis*, although it is undoubtedly closely related to its members. Taxonomic relationships within this hypothesised section are complex and the unambiguous distinction of *S. floribunda* and *S. hians*, *S. hians* and *S. reticulata*, and *S. reticulata* and *S. favosa* can be difficult, due to similarities in habit and leaf, flower and stigma morphology, as well as intergrades in leaf texture and reticulation, and flower and bract size and pubescence. *Synaphea floribunda s. str.* is also very similar to the geographically disjunct taxon *Synaphea* sp. Darkin (F. Hort et al. 586) but further field work, especially through intermediate areas, is required to clarify the status of this phrase-named taxon.

Many specimens of *Synaphea spinulosa* have projections arising from the apex of the ventral surface of the stigma and these take the form of either a simple or bifurcating projection of stigmatic tissue. It is hypothesised that this structure may increase the effectiveness of pollen removal from the under-surface of insect visitors.

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